

|                   |                                                                                       |                                 |
|-------------------|---------------------------------------------------------------------------------------|---------------------------------|
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|                   | LARGE LIQUID CRYSTAL DISPLAY<br>BUSSINESS GROUP<br>SHARP CORPORATION<br>SPECIFICATION | LIQUID CRYSTAL DISPLAY DIVISION |

DEVICE SPECIFICATION FOR

**TFT-LCD Module**

Model No. LK800D3LA48

CUSTOMER'S APPROVAL

DATE

PRESENTED

BY \_\_\_\_\_

BY

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SHARP CORPORATION

## RECORDS OF REVISION

MODEL No. : LK800D3LA48

SPEC No. : LD-K24303

[illegible]

## 1. Application

This technical literature applies to the color 80.0" TFT-LCD Module LK800D3LA48.

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## 2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit, LED driver circuit and back light system etc. Graphics and texts can be displayed on a 1920×RGB×1080 dots panel with one billion colors by using LVDS (Low Voltage Differential Signaling) to interface, +12V of DC supply voltages.

This module includes the DC driver circuit to drive the LED. (+24V of DC supply voltage)

And in order to improve the response time of LCD, this module applies the Over Shoot driving (O/S driving) technology for the control circuit. In the O/S driving technology, signals are being applied to the Liquid Crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

With this technology, image signals can be set so that liquid crystal response completes within one frame. As a result, motion blur reduces and clearer display performance can be realized.

This LCD module also adopts Double Frame Rate driving method including FRC (Frame Rate Control) function on the control circuit. Therefore the input signal to this LCD module is Single Frame Rate, but the output is Double-Frame Rate picture. FRC of this module is a game (PC) mode setup.

With combination of these technologies, motion blur can be reduced and clearer display performance can be realized.

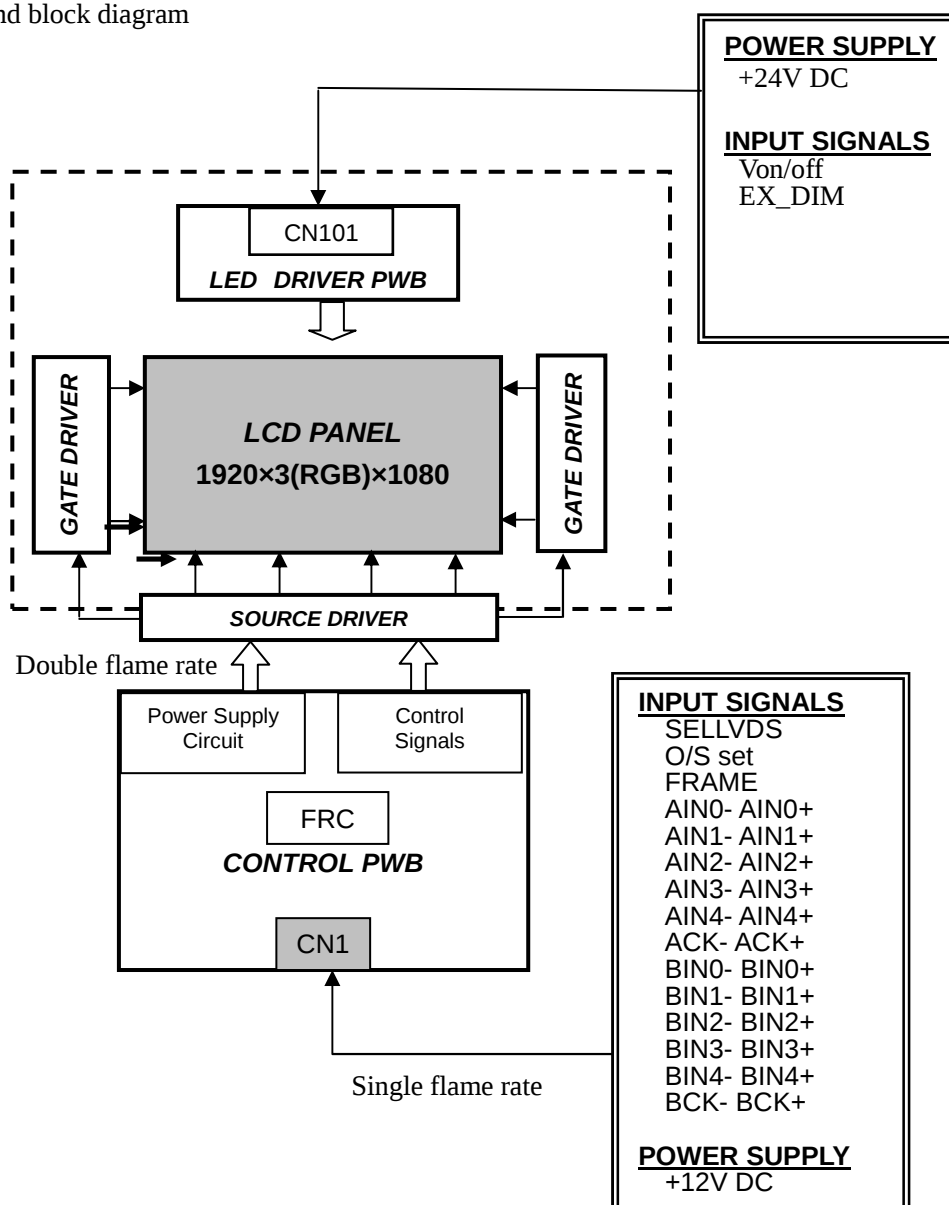
### 3. Mechanical Specifications

| Parameter                    | Specifications                                   | Unit       |
|------------------------------|--------------------------------------------------|------------|
| Display size                 | 203.218 (Diagonal)<br>80.0 (Diagonal)            | cm<br>inch |
| Active area                  | 1771.200 (H) x 996,300 (V)                       | mm         |
| Pixel Format                 | 1920 (H) x 1080 (V)<br>(1pixel = R + G + B dot)  | pixel      |
| Pixel pitch                  | 0.9225 (H) x 0.9225 (V)                          | mm         |
| Pixel configuration          | R, G, B vertical stripe                          |            |
| Display mode                 | Normally black                                   |            |
| Open Cell Outline Dimensions | 1820.2(H) x 1045.3(V) x 26(D)                    | mm         |
| Mass                         | 34.0 ± 1.0                                       | kg         |
| Surface treatment            | Low-Haze Anti glare<br>Hard coating: 2H and more |            |

(\*1) Outline dimensions are shown in p.22 (excluding protruding portion)

### 4. Input Terminals

#### 4.1. Interface and block diagram



## 4.2. TFT panel driving

CN1 (Interface signals and +12V DC power supply)

Using connector : FI-RNE51SZ-HF (Japan Aviation Electronics Ind., Ltd.)

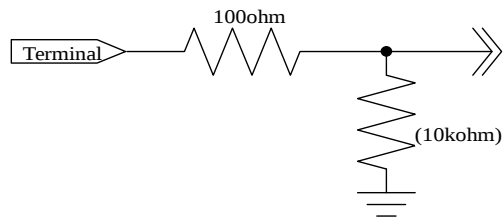
Mating connector : FI-RE51HL, FI-RE51CL (Japan Aviation Electronics Ind., Ltd.) or equivalent device

Mating LVDS transmitter : THC63LVD1023 or equivalent device

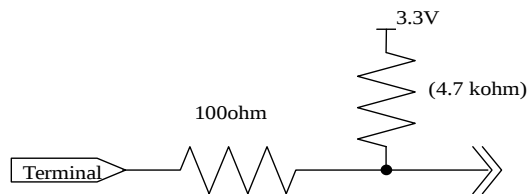
| Pin No. | Symbol   | Function                                    | Remark                   |
|---------|----------|---------------------------------------------|--------------------------|
| 1       | GND      |                                             |                          |
| 2       | Reserved | It is required to set non-connection(OPEN)] | Pull UP: (3.3V) [Note3]  |
| 3       | Reserved | It is required to set non-connection(OPEN)  | Pull UP: (3.3V) [Note3]  |
| 4       | Reserved | It is required to set non-connection(OPEN)  |                          |
| 5       | Reserved | It is required to set non-connection(OPEN)  |                          |
| 6       | Reserved | It is required to set non-connection(OPEN)  |                          |
| 7       | SELLVDS  | Select LVDS data order [Note4]              | Pull down: (GND) [Note2] |
| 8       | Reserved | It is required to set non-connection(OPEN)  |                          |
| 9       | O/S set  | O/S operation setting H:O/S_ON, L:O/S_OFF   | Pull UP: (3.3V) [Note3]  |
| 10      | FRAME    | Frame frequency setting 1:60Hz 0:50Hz       | Pull down: (GND) [Note2] |
| 11      | GND      |                                             |                          |
| 12      | AIN0-    | Aport (-)LVDS CH0 differential data input   |                          |
| 13      | AIN0+    | Aport (+)LVDS CH0 differential data input   |                          |
| 14      | AIN1-    | Aport (-)LVDS CH1 differential data input   |                          |
| 15      | AIN1+    | Aport (+)LVDS CH1 differential data input   |                          |
| 16      | AIN2-    | Aport (-)LVDS CH2 differential data input   |                          |
| 17      | AIN2+    | Aport (+)LVDS CH2 differential data input   |                          |
| 18      | GND      |                                             |                          |
| 19      | ACK-     | Aport LVDS Clock signal(-)                  |                          |
| 20      | ACK+     | Aport LVDS Clock signal(+)                  |                          |
| 21      | GND      |                                             |                          |
| 22      | AIN3-    | Aport (-)LVDS CH3 differential data input   |                          |
| 23      | AIN3+    | Aport (+)LVDS CH3 differential data input   |                          |
| 24      | AIN4-    | Aport (-)LVDS CH4 differential data input   |                          |
| 25      | AIN4+    | Aport (+)LVDS CH4 differential data input   |                          |
| 26      | GND      |                                             |                          |
| 27      | GND      |                                             |                          |
| 28      | BIN0-    | Bport (-)LVDS CH0 differential data input   |                          |
| 29      | BIN0+    | Bport (+)LVDS CH0 differential data input   |                          |
| 30      | BIN1-    | Bport (-)LVDS CH1 differential data input   |                          |
| 31      | BIN1+    | Bport (+)LVDS CH1 differential data input   |                          |
| 32      | BIN2-    | Bport (-)LVDS CH2 differential data input   |                          |
| 33      | BIN2+    | Bport (+)LVDS CH2 differential data input   |                          |
| 34      | GND      |                                             |                          |
| 35      | BCK-     | Bport LVDS Clock signal(-)                  |                          |
| 36      | BCK+     | Bport LVDS Clock signal(+)                  |                          |
| 37      | GND      |                                             |                          |
| 38      | BIN3-    | Bport (-)LVDS CH3 differential data input   |                          |
| 39      | BIN3+    | Bport (+)LVDS CH3 differential data input   |                          |
| 40      | BIN4-    | Bport (-)LVDS CH4 differential data input   |                          |
| 41      | BIN4+    | Bport (+)LVDS CH4 differential data input   |                          |
| 42      | GND      |                                             |                          |
| 43      | GND      |                                             |                          |
| 44      | GND      |                                             |                          |
| 45      | GND      |                                             |                          |
| 46      | GND      |                                             |                          |
| 47      | VCC      | +12V Power Supply                           |                          |
| 48      | VCC      | +12V Power Supply                           |                          |
| 49      | VCC      | +12V Power Supply                           |                          |
| 50      | VCC      | +12V Power Supply                           |                          |
| 51      | VCC      | +12V Power Supply                           |                          |

[Note1] GND of a liquid crystal panel drive part has connected with a module chassis.

[Note2] The equivalent circuit figure of the terminal.



[Note3] The equivalent circuit figure of the terminal.

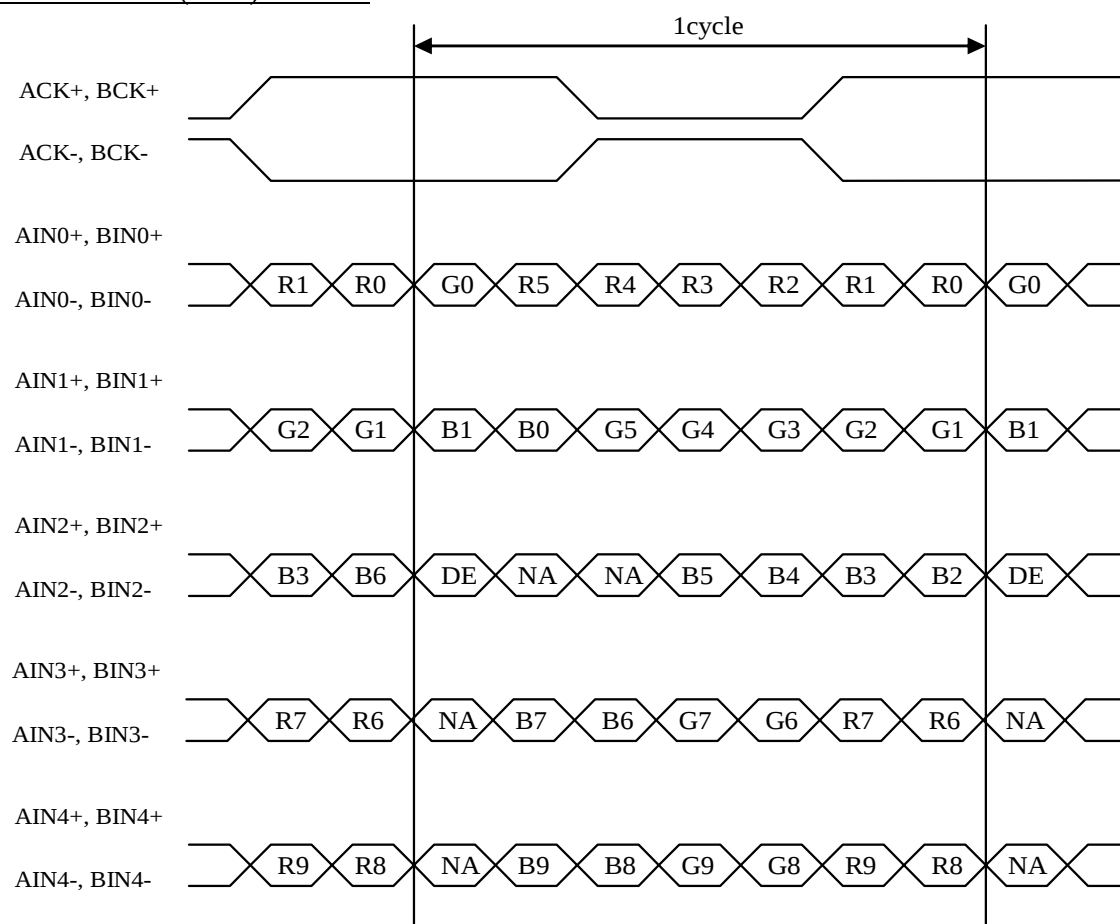
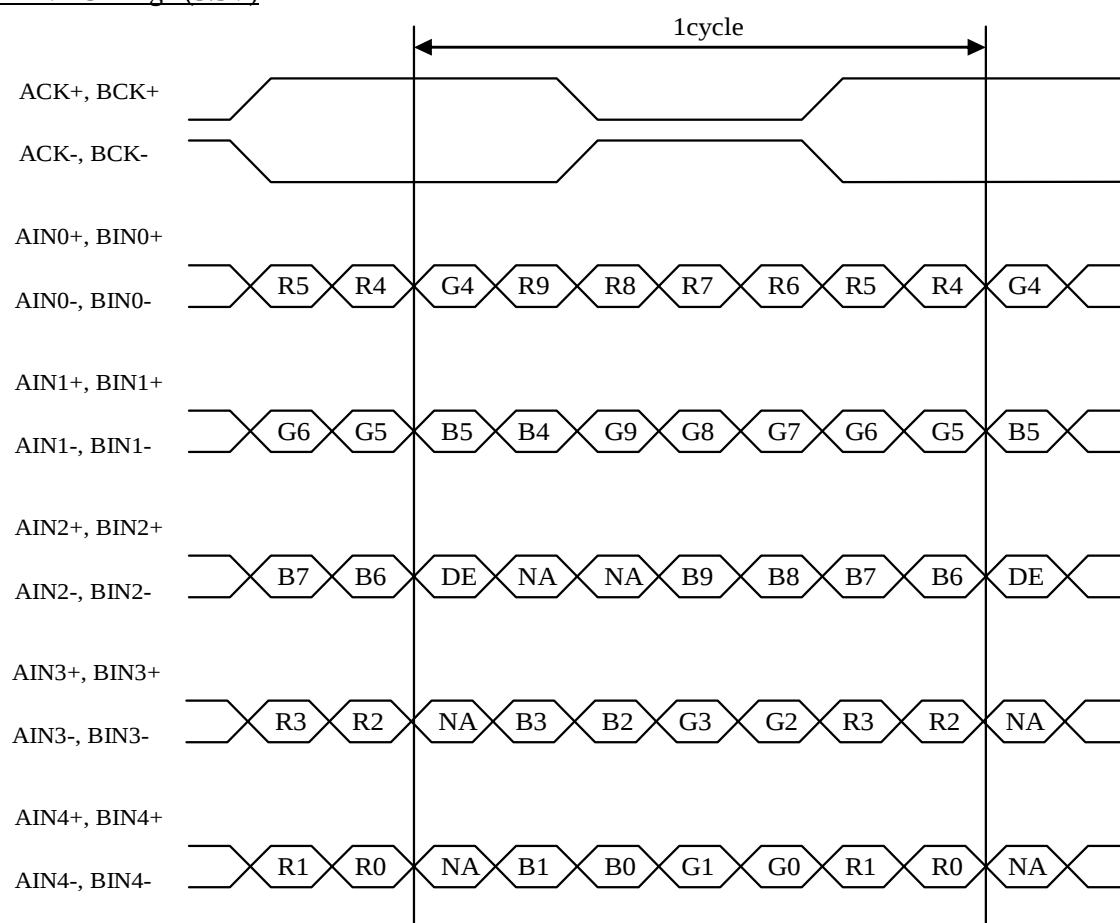


[Note4] LVDS Data order

| SELLVDS |                          |                    |
|---------|--------------------------|--------------------|
| Data    | L(GND) or OPEN<br>[VESA] | H(3.3V)<br>[JEIDA] |
| TA0     | R0(LSB)                  | R4                 |
| TA1     | R1                       | R5                 |
| TA2     | R2                       | R6                 |
| TA3     | R3                       | R7                 |
| TA4     | R4                       | R8                 |
| TA5     | R5                       | R9(MSB)            |
| TA6     | G0(LSB)                  | G4                 |
| TB0     | G1                       | G5                 |
| TB1     | G2                       | G6                 |
| TB2     | G3                       | G7                 |
| TB3     | G4                       | G8                 |
| TB4     | G5                       | G9(MSB)            |
| TB5     | B0(LSB)                  | B4                 |
| TB6     | B1                       | B5                 |
| TC0     | B2                       | B6                 |
| TC1     | B3                       | B7                 |
| TC2     | B4                       | B8                 |
| TC3     | B5                       | B9(MSB)            |
| TC4     | NA                       | NA                 |
| TC5     | NA                       | NA                 |
| TC6     | DE(*)                    | DE(*)              |
| TD0     | R6                       | R2                 |
| TD1     | R7                       | R3                 |
| TD2     | G6                       | G2                 |
| TD3     | G7                       | G3                 |
| TD4     | B6                       | B2                 |
| TD5     | B7                       | B3                 |
| TD6     | N/A                      | N/A                |
| TE0     | R8                       | R0(LSB)            |
| TE1     | R9(MSB)                  | R1                 |
| TE2     | G8                       | G0(LSB)            |
| TE3     | G9(MSB)                  | G1                 |
| TE4     | B8                       | B0(LSB)            |
| TE5     | B9(MSB)                  | B1                 |
| TE6     | N/A                      | N/A                |

NA: Not Available

(\*)Since the display position is prescribed by the rise of DE (Display Enable) signal, please do not fix DE signal during operation at "High".

SELLVDS= Low (GND) or OPENSELLVDS= High (3.3V)

DE: Display Enable, NA: Not Available (Fixed Low)



### 4.3. Backlight driving

CN101 (+24V DC power supply and inverter control)

Using connector: 20022WR-14B1(YEONHO)

Mating connector: 20022HS-14L (YEONHO) or equivalent connector.

| Pin No. | Symbol           | I/O | Function                        | Default(OPEN)                     | Input Impedance (min)    | Remark                    |
|---------|------------------|-----|---------------------------------|-----------------------------------|--------------------------|---------------------------|
| 1       | V <sub>LED</sub> | In  | +24V                            | -                                 |                          |                           |
| 2       | V <sub>LED</sub> | In  | +24V                            | -                                 |                          |                           |
| 3       | V <sub>LED</sub> | In  | +24V                            | -                                 |                          |                           |
| 4       | V <sub>LED</sub> | In  | +24V                            | -                                 |                          |                           |
| 5       | V <sub>LED</sub> | In  | +24V                            | -                                 |                          |                           |
| 6       | GND              | In  | GND                             | -                                 |                          |                           |
| 7       | GND              | In  | GND                             | -                                 |                          |                           |
| 8       | GND              | In  | GND                             | -                                 |                          |                           |
| 9       | GND              | In  | GND                             | -                                 |                          |                           |
| 10      | GND              | In  | GND                             | -                                 |                          |                           |
| 11      | Error_out        | Out | Error Detection                 | Open Collector                    |                          | [Note 1]                  |
| 12      | Von/off          | In  | LED driver On/Off               | LED driver Off                    | 10k-ohm pull-down to GND | [Note 2]                  |
| 13      | NC               | -   | -                               | -                                 |                          |                           |
| 14      | EX_DIM           | In  | Brightness Control (PWM 1~100%) | 3.3V : pull up<br>Brightness 100% | 10k-ohm pull-up to 3.3V  | [Note 3]<br>Pulse Dimming |

[Note 1] Error Detection

|          | MIN            | TYP | MAX  |
|----------|----------------|-----|------|
| Normal   | -              | -   | 0.8V |
| Abnormal | Open Collector |     |      |

Terminal load capacitance : 100pF

[Note 2] LED driver ON/OFF

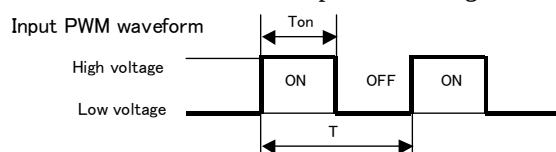
| Input voltage | Symbol | Function         |
|---------------|--------|------------------|
| High voltage  | Von    | LED driver : On  |
| Low voltage   | Voff   | LED driver : Off |

High voltage: 2.4~3.6V

Low voltage: -0.3~0.8V

[Note3] Pulse Dimming

Pin No.14 'EX\_DIM' is used for the pulse dimming control by the PWM duty with input pulse from 90Hz to 360Hz.



$$\text{Duty} = \text{Ton} / \text{T}$$

High voltage: 2.4~3.6V

Low voltage: -0.3~0.8V

|                                 |      | MIN | TYP | MAX | Remark  |
|---------------------------------|------|-----|-----|-----|---------|
| Pulse signal                    | [Hz] | 90  | -   | 360 |         |
| DUTY(Ton/T)                     | [%]  | 1   | -   | 100 | Ta=25°C |
| Dimming level (luminance ratio) | [%]  | -   | -   | 100 | Ta=25°C |

4.4. The back light system characteristics

The characteristics of the LED are shown in the following table. The value mentioned below is at the case of One LED.

| Item      | Symbol | Min. | Typ.   | Max. | Unit | Remarks      |
|-----------|--------|------|--------|------|------|--------------|
| Life time | TLED   | -    | 50,000 | -    | Hour | 25℃ [Note.1] |

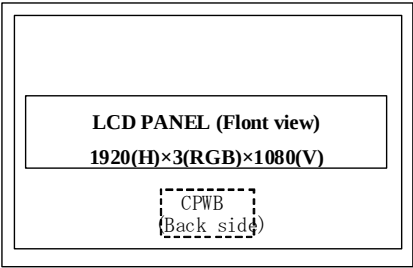
[Note1] LED life time is the expectation value calculated from lifetime data of maker report. It is defined as the time when brightness becomes 50% of the original value in the continuous operation under the condition of Ta=25℃. It is assumed that LED current becomes 70% when the LED dimming duty ratio is 70% and calculates.

5 Installation and Display direction

This module can be installed by both installation direction “landscape” and “portrait” as follows.

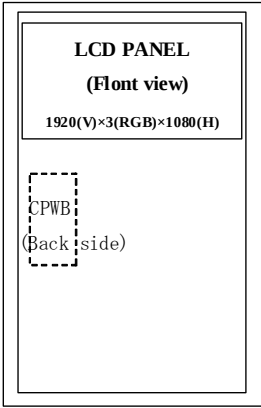
[Landscape direction]

In front view, CPWB is located BOTTOM



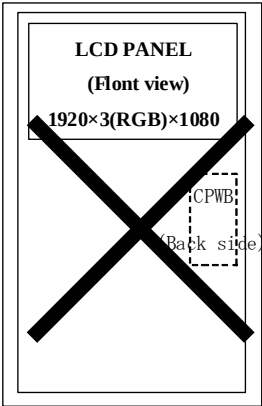
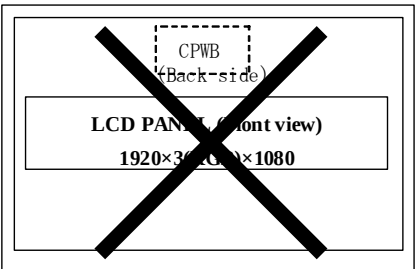
[Portrait direction]

In front view, CPWB is located Left-side



[Note] Other installation direction

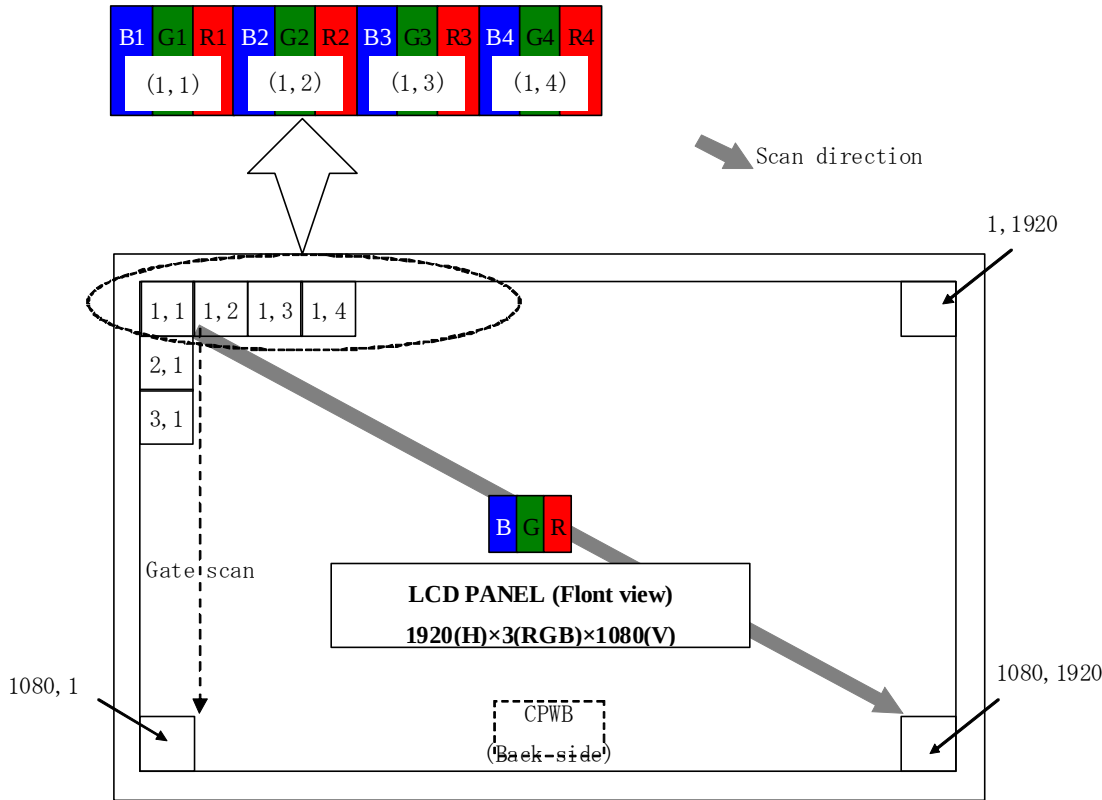
Since in case of the other installation direction the characteristic and reliability cannot be guaranteed, **NOT recommended.**



5.2 Display direction

Each subpixel R, G, B is aligned as follows.

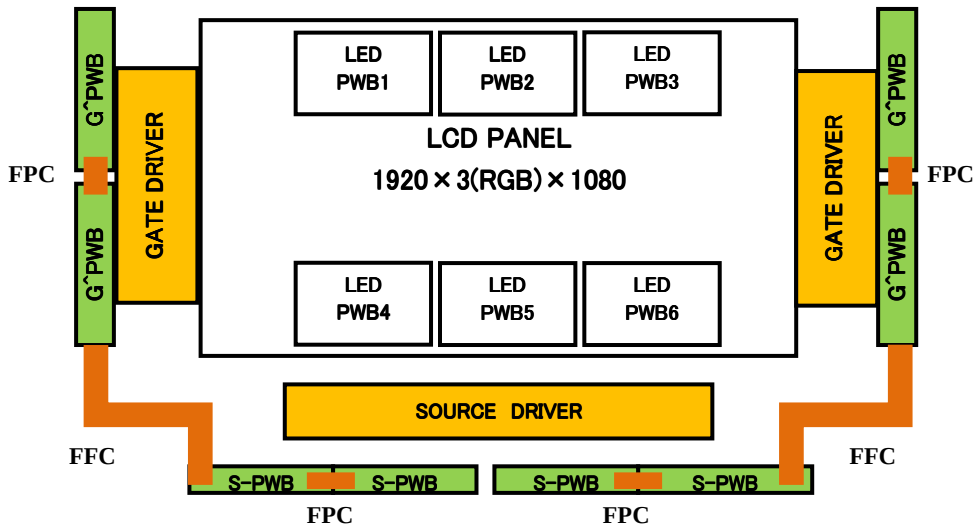
[Landscape direction]



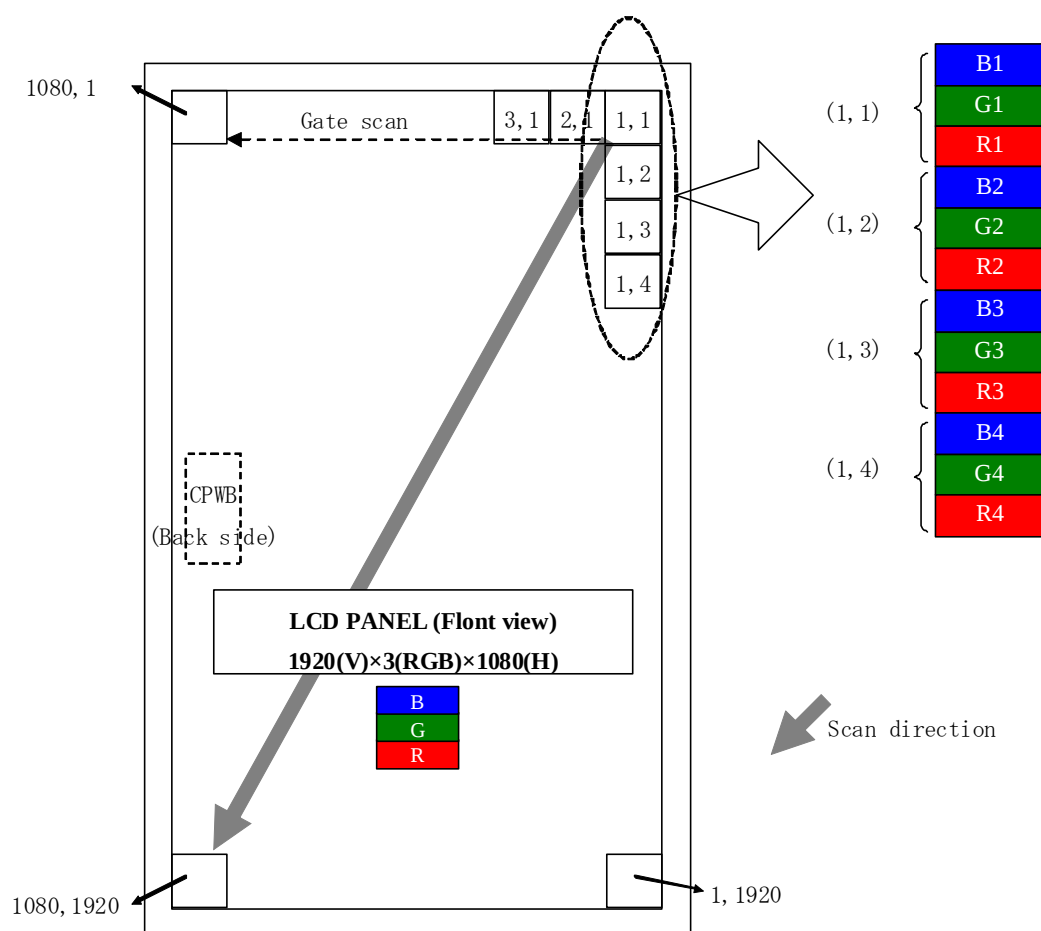
**LCD subpixel alignment in Landscape installaion**

[Note] PWB layout

In Landscape installation,  
Four S-PWBs and three LED-PWBs are layout at the bottom side of the screen.



**Layout of LED-PWB, S-PWB & G-PWB (Front View)**

**[Portrait direction]****LCD subpixel alignment in Portrait installaion****6. Absolute Maximum Ratings**

| Parameter                              | Symbol                                   | Condition             | Ratings    | Unit | Remark   |
|----------------------------------------|------------------------------------------|-----------------------|------------|------|----------|
| Input voltage<br>(for C-PWB)           | V <sub>I</sub>                           | T <sub>a</sub> =25°C  | -0.3 ~ 3.6 | V    | [Note 1] |
| 12V supply voltage<br>(for C-PWB)      | V <sub>CC</sub>                          | T <sub>a</sub> =25°C  | 0 ~ + 14   | V    |          |
| Input voltage<br>(for LED Driver)      | V <sub>on/off</sub><br>DIM_SEL<br>EX_DIM | T <sub>a</sub> =25 °C | -0.3 ~ 3.9 | V    |          |
| 24V supply voltage<br>(for LED Driver) | V <sub>LED</sub>                         | T <sub>a</sub> =25 °C | 0 ~ + 24   | V    |          |
| Storage temperature                    | T <sub>stg</sub>                         | -                     | -25 ~ +60  | °C   | [Note 2] |
| Operation temperature<br>(Ambient)     | T <sub>opa</sub>                         | -                     | 0 ~ +50    | °C   |          |

[Note 1] SELLVDS、OS set、FRAME

[Note 2] Humidity 95%RH Max.(T<sub>a</sub>≤40°C)Maximum wet-bulb temperature at 39 °C or less.(T<sub>a</sub>>40°C)

No condensation.

## 7. Electrical Characteristics

### 7.1 Control circuit driving

Ta=25 °C

| Parameter                              |                     | Symbol            | Min.                | Typ. | Max.                         | Unit              | Remark                            |
|----------------------------------------|---------------------|-------------------|---------------------|------|------------------------------|-------------------|-----------------------------------|
| +12V supply voltage                    | Supply voltage      | V <sub>CC</sub>   | 11.4                | 12   | 12.6                         | V                 | [Note 1]                          |
|                                        | Current dissipation | I <sub>CC</sub>   | -                   | 1.1  | 3.0                          | A                 | [Note 2]                          |
|                                        | Inrush current      | I <sub>RUSH</sub> | -                   | 4.1  | -                            | A                 | t <sub>1</sub> =500us<br>[Note 7] |
| Permissible input ripple voltage       |                     | V <sub>RP</sub>   | -                   | -    | 100                          | mV <sub>P-P</sub> | V <sub>CC</sub> = +12.0V          |
| Input Low voltage                      |                     | V <sub>IL</sub>   | 0                   | -    | 1.0                          | V                 | [Note 3]                          |
| Input High voltage                     |                     | V <sub>IH</sub>   | 2.3                 | -    | 3.3                          | V                 |                                   |
| Input leak current (Low)               |                     | I <sub>IL1</sub>  | -                   | -    | 40                           | μA                | V <sub>I</sub> = 0V<br>[Note 4]   |
|                                        |                     | I <sub>IL2</sub>  |                     |      | 750                          | μA                | V <sub>I</sub> = 0V<br>[Note 5]   |
| Input leak current (High)              |                     | I <sub>IH1</sub>  | -                   | -    | 400                          | μA                | V <sub>I</sub> = 3.3V<br>[Note 4] |
|                                        |                     | I <sub>IH2</sub>  | -                   | -    | 40                           | μA                | V <sub>I</sub> = 3.3V<br>[Note 5] |
| Terminal resistor                      |                     | R <sub>T</sub>    | -                   | 100  | -                            | Ω                 | Differential input                |
| Input Differential voltage             |                     | V <sub>ID</sub>   | 200                 | 400  | 600                          | mV                | [Note 6]                          |
| Differential input common mode voltage |                     | V <sub>CM</sub>   | V <sub>ID</sub>  /2 | 1.2  | 2.4-<br> V <sub>ID</sub>  /2 | V                 | [Note 6]                          |

[Note]V<sub>CM</sub>: Common mode voltage of LVDS driver.

[Note1]

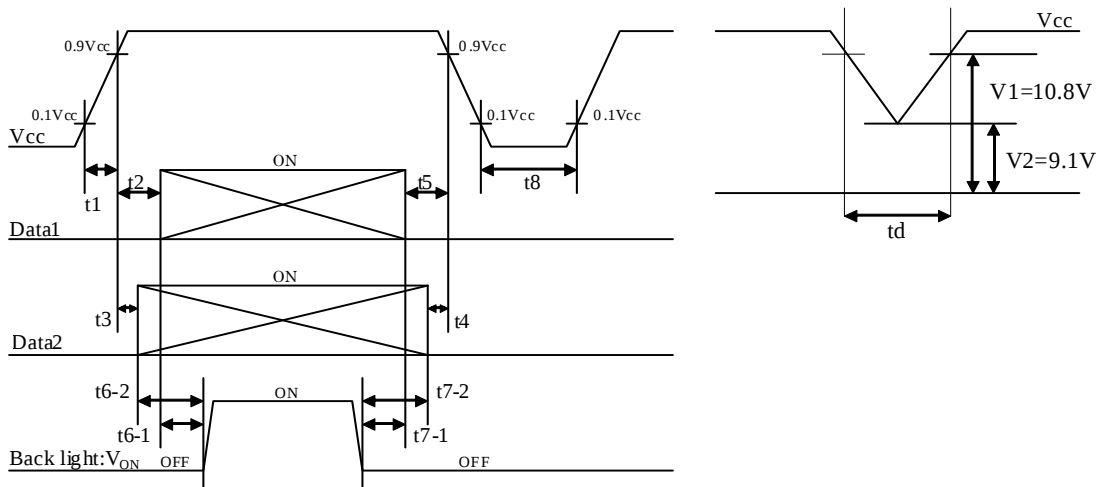
#### Input voltage sequences

50us. < t<sub>1</sub> < 20ms20ms.< t<sub>2</sub> < 5s20ms < t<sub>3</sub> < 5s0 < t<sub>4</sub> < 1s0 < t<sub>5</sub> < 1s(1sec) < t<sub>6-1</sub>(1sec) < t<sub>6-2</sub>0 < t<sub>7-1</sub>0 < t<sub>7-2</sub>1s < t<sub>8</sub>

#### Dip conditions for supply voltage

a) V<sub>2</sub> ≤ V<sub>CC</sub> < V<sub>1</sub>t<sub>d</sub> < 10msb) V<sub>CC</sub> < V<sub>2</sub>

This case is based on input voltage sequences.



※ Data1: ACK±, AIN0±, AIN1±, AIN2±, AIN3±, AIN4±, BCK±, BIN0±, BIN1±, BIN2±, BIN3±, BIN4±,

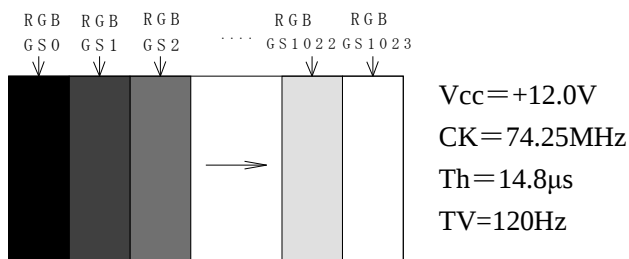
\*V<sub>CM</sub> voltage pursues the sequence mentioned above

※ Data2: SELLVDS, O/S set, FRAME

[Note] About the relation between data input and back light lighting, please base on the above-mentioned input sequence. When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.

[Note 2] Typical current situation: 1024 gray-bar patterns. ( $V_{CC} = +12.0V$ )

The explanation of RGB gray scale is seen in section 8.

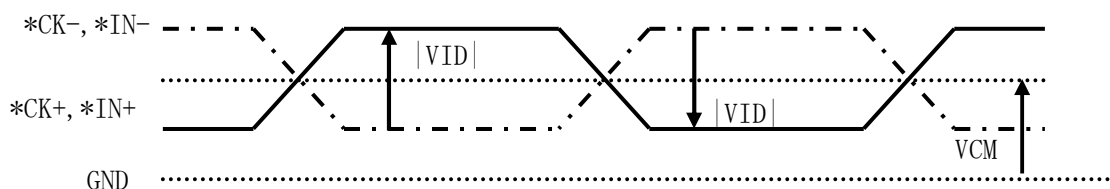


[Note 3] SELLVDS、FRAME、O/S set

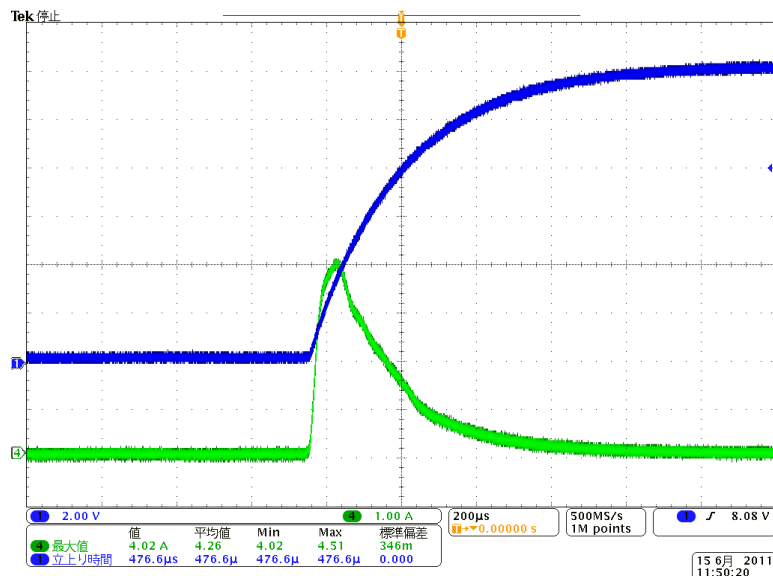
[Note 4] SELLVDS、FRAME

[Note 5] O/S set

[Note 6]  $ACK\pm$ ,  $AIN0\pm$ ,  $AIN1\pm$ ,  $AIN2\pm$ ,  $AIN3\pm$ ,  $AIN4\pm$ ,  $BCK\pm$ ,  $BIN0\pm$ ,  $BIN1\pm$ ,  $BIN2\pm$ ,  $BIN3\pm$ ,  $BIN4\pm$



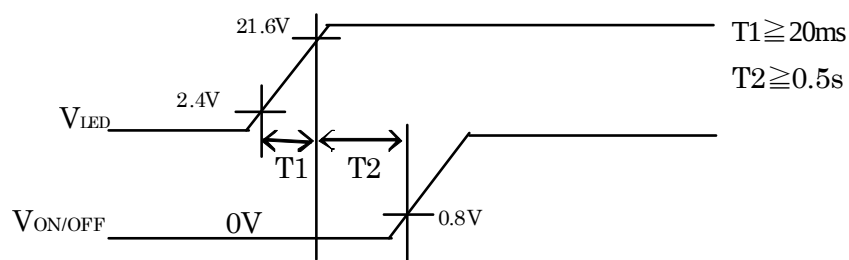
[Note 7]  $V_{CC}12V$  inrush current waveform



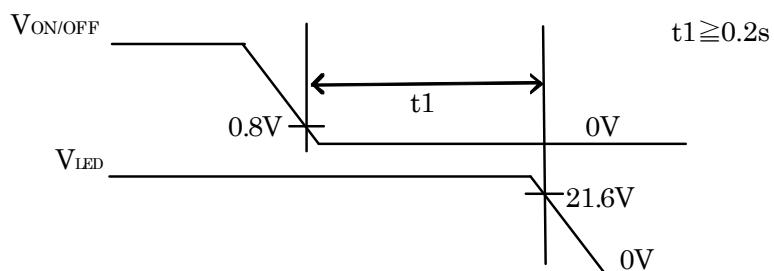
## 7.2 LED driving for back light

| Parameter                        |                     | Symbol     | Min. | Typ. | Max. | Unit             | Remark                                           |
|----------------------------------|---------------------|------------|------|------|------|------------------|--------------------------------------------------|
| +24V supply voltage              | Current dissipation | $I_{LEDD}$ | -    | 11.5 | 12.7 | A                | $V_{LED}=+24V$<br>$T_a=25^{\circ}C$<br>DUTY=100% |
|                                  | Irush current       | $I_{RUSH}$ | -    | 16   | -    | A                |                                                  |
|                                  | Supply voltage      | $V_{LED}$  | 21.6 | 24.0 | 26.4 | V                |                                                  |
| Permissible input ripple voltage |                     | $V_{RP}$   | -    | -    | 1    | V <sub>P-P</sub> | $V_{LED}=+24.0V$                                 |
| Input voltage (On)               |                     | $V_{ON}$   | 2.4  | 3.0  | 3.6  | V                | $V_{ON/OFF}$ ,<br>EX_DIM                         |
| Input voltage (Off)              |                     | $V_{OFF}$  | -0.3 | 0    | 0.8  | V                |                                                  |
| Input voltage(DIM High)          |                     | $V_{DIMH}$ | 2.4  | -    | 3.6  | V                | DIM_SEL                                          |
| Input voltage(DIM Low)           |                     | $V_{DIML}$ | -0.3 | -    | 0.8  | V                |                                                  |

[Note ]  $V_{LED}$ -turn-on condition



2)  $V_{LED}$ -turn-off condition



## 8. Timing characteristics of input signals

### 8.1 Timing characteristics

Timing diagrams of input signal are shown in Fig.2.

| Parameter          |                          | Symbol | Min. | Typ.  | Max. | Unit  | Remark |
|--------------------|--------------------------|--------|------|-------|------|-------|--------|
| Clock              | Frequency                | 1/Tc   | 67   | 74.25 | 76   | MHz   |        |
| Data enable signal | Horizontal period        | TH     | 1050 | 1100  | 1300 | clock |        |
|                    |                          |        | 14.2 | 14.8  | 16.1 | μs    |        |
|                    | Horizontal period (High) | THd    | 960  | 960   | 960  | clock |        |
|                    | Vertical period          | TV     | 1109 | 1125  | 1400 | line  |        |
|                    |                          |        | 47   | 60    | 61   | Hz    |        |
|                    | Vertical period (High)   | TVd    | 1080 | 1080  | 1080 | line  |        |

[Note]-When vertical period is very long, flicker and etc. may occur.

-Please turn off the module after it shows the black screen.

-Please make sure that length of vertical period should become of an integral multiple of horizontal length of period. Otherwise, the screen may not display properly.

-As for your final setting of driving timing, we will conduct operation check test at our side, please inform your final setting.

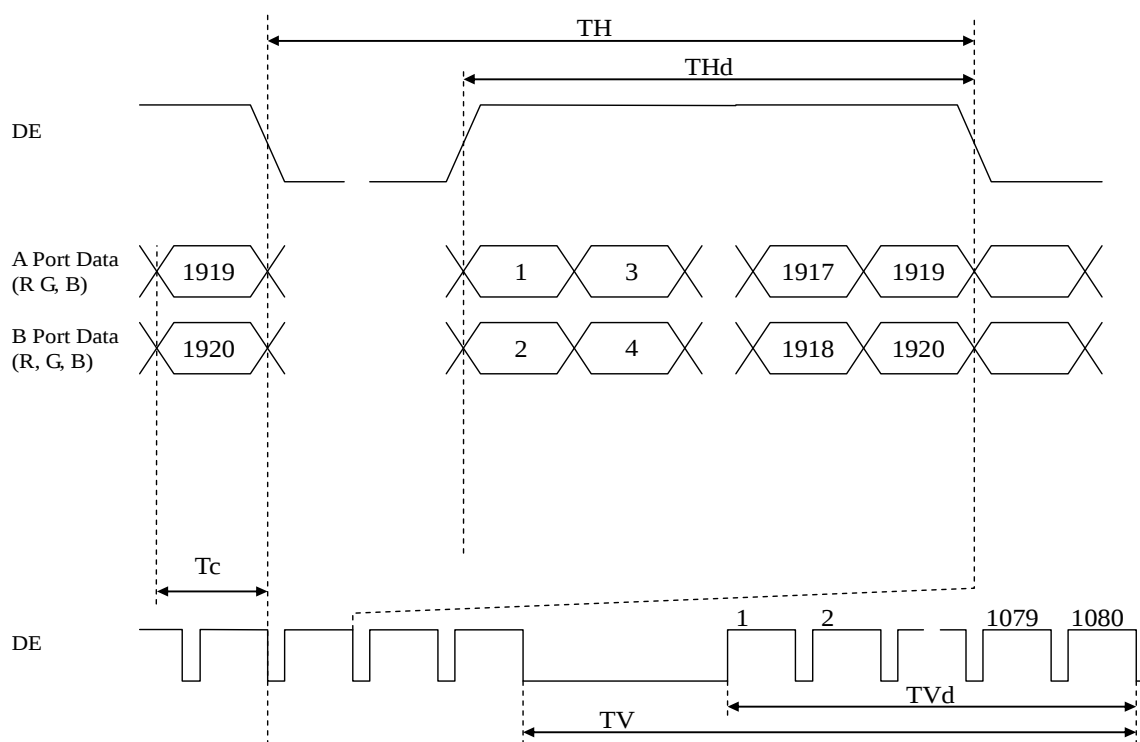
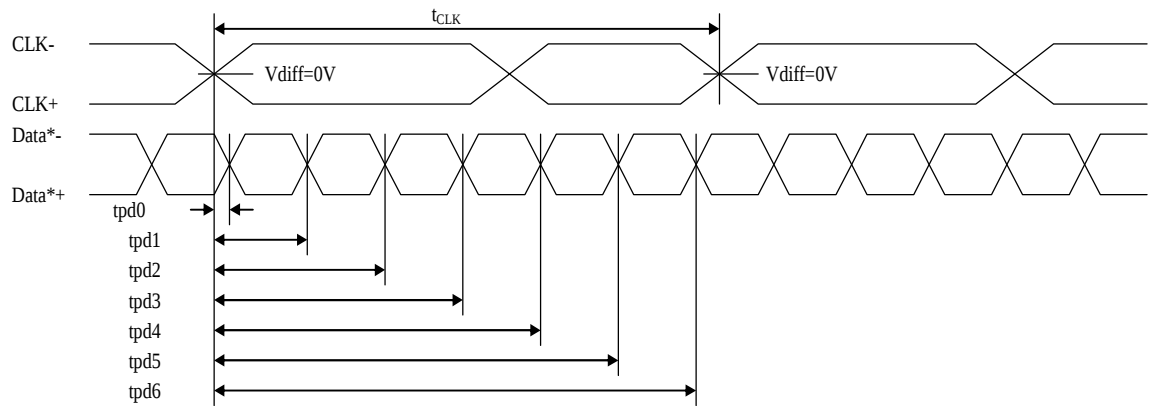


Fig.2 Timing diagram of input signal



## 8.2 LVDS signal characteristics



| Item          |                                                      | Symbol | Min.                       | Typ.                | Max.                       | Unit |
|---------------|------------------------------------------------------|--------|----------------------------|---------------------|----------------------------|------|
| Data position | Delay time, CLK rising edge to serial bit position 0 | tpd0   | -0.25                      | 0                   | 0.25                       | ns   |
|               | Delay time, CLK rising edge to serial bit position 1 | tpd1   | $1 \cdot t_{CLK}/7 - 0.25$ | $1 \cdot t_{CLK}/7$ | $1 \cdot t_{CLK}/7 + 0.25$ |      |
|               | Delay time, CLK rising edge to serial bit position 2 | tpd2   | $2 \cdot t_{CLK}/7 - 0.25$ | $2 \cdot t_{CLK}/7$ | $2 \cdot t_{CLK}/7 + 0.25$ |      |
|               | Delay time, CLK rising edge to serial bit position 3 | tpd3   | $3 \cdot t_{CLK}/7 - 0.25$ | $3 \cdot t_{CLK}/7$ | $3 \cdot t_{CLK}/7 + 0.25$ |      |
|               | Delay time, CLK rising edge to serial bit position 4 | tpd4   | $4 \cdot t_{CLK}/7 - 0.25$ | $4 \cdot t_{CLK}/7$ | $4 \cdot t_{CLK}/7 + 0.25$ |      |
|               | Delay time, CLK rising edge to serial bit position 5 | tpd5   | $5 \cdot t_{CLK}/7 - 0.25$ | $5 \cdot t_{CLK}/7$ | $5 \cdot t_{CLK}/7 + 0.25$ |      |
|               | Delay time, CLK rising edge to serial bit position 6 | tpd6   | $6 \cdot t_{CLK}/7 - 0.25$ | $6 \cdot t_{CLK}/7$ | $6 \cdot t_{CLK}/7 + 0.25$ |      |

## 9. Input signal, basic display colors and gray scale of each color

| Colors & Gray Scale |          |        | Data signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
|---------------------|----------|--------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|
|                     |          |        | R0          | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | G8 | G9 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 |   |
| Basic Color         | Black    | —      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Blue     | —      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
|                     | Green    | —      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Cyan     | —      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
|                     | Red      | —      | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Magenta  | —      | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
|                     | Yellow   | —      | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | White    | —      | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
| Gray Scale of Red   | Black    | GS0    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | ---      | GS1    | 1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Darker   | GS2    | 0           | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | ---      | ↓      |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
|                     | ---      | ↓      |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
|                     | Brighter | GS1021 | 1           | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |
|                     | ---      | GS1022 | 0           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Red      | GS1023 | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |
| Gray Scale of Green | Black    | GS0    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | ---      | GS1    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Darker   | GS2    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | ---      | ↓      |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
|                     | ---      | ↓      |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
|                     | Brighter | GS1021 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |
|                     | ---      | GS1022 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Green    | GS1023 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 |
| Gray Scale of Blue  | Black    | GS0    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | ---      | GS1    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | Darker   | GS2    | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |   |
|                     | ---      | ↓      |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
|                     | ---      | ↓      |             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
|                     | Brighter | GS1021 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
|                     | ---      | GS1022 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
|                     | Blue     | GS1023 | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |

0: Low level voltage / 1: High level voltage

Each basic color can be displayed in 1021 gray scales from 10 bits data signals. According to the combination of total 30 bits data signals, one billion-color display can be achieved on the screen.

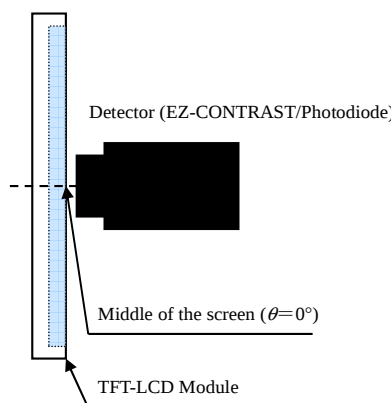
## 10. Optical characteristics

$T_a=25^{\circ}\text{C}$ ,  $V_{CC}=12\text{V}$ ,  $V_{LED}=+24\text{V}$ , Brightness 100%, Timing: 60Hz (typ. value)

| Parameter            |            | Symbol                         | Condition       | Min.      | Typ.  | Max.              | Unit    | Remark      |
|----------------------|------------|--------------------------------|-----------------|-----------|-------|-------------------|---------|-------------|
| Viewing angle range  | Horizontal | $\theta_{21}$<br>$\theta_{22}$ | CR $\geq$ 10    | 70        | 88    | -                 | Deg.    | [Note1,4]   |
|                      | Vertical   | $\theta_{11}$<br>$\theta_{12}$ |                 | 70        | 88    | -                 | Deg.    |             |
| Contrast ratio       |            | CRn                            | $\theta=0$ deg. | 4000      | 5000  | -                 | -       | [Note2,4]   |
| Response time        |            | $\tau_{rd}$                    |                 | -         | 4     | -                 | ms      | [Note3,4,5] |
| Chromaticity         | White      | x                              |                 | Typ.-0.03 | 0.282 | Typ.+0.03         | -       | [Note4]     |
|                      |            | y                              |                 | Typ.-0.03 | 0.288 | Typ.+0.03         | -       |             |
|                      | Red        | x                              |                 | Typ.-0.03 | 0.640 | Typ.+0.03         | -       |             |
|                      |            | y                              |                 | Typ.-0.03 | 0.348 | Typ.+0.03         | -       |             |
|                      | Green      | x                              |                 | Typ.-0.03 | 0.300 | Typ.+0.03         | -       |             |
|                      |            | y                              |                 | Typ.-0.03 | 0.623 | Typ.+0.03         | -       |             |
|                      | Blue       | x                              |                 | Typ.-0.03 | 0.149 | Typ.+0.03         | -       |             |
|                      |            | y                              |                 | Typ.-0.03 | 0.057 | Typ.+0.03         | -       |             |
| Luminance            | White      | $Y_L$                          | 560             | 700       | -     | cd/m <sup>2</sup> |         |             |
| Luminance uniformity | White      | $\delta_w$                     | -               | 1.33      |       |                   | [Note6] |             |

- Measurement condition: Set the value of backlight control voltage to maximum luminance of white.
- The measurement shall be executed 60 minutes after lighting at rating.

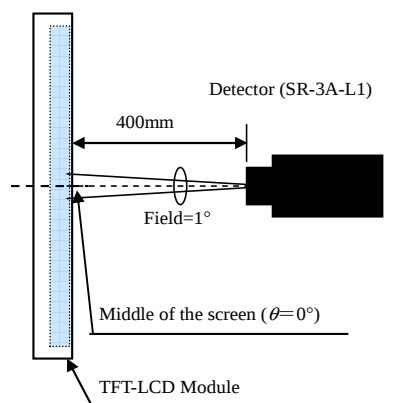
[Note] The optical characteristics are measured using the following equipment.



Measurement of viewing angle range and Response time.

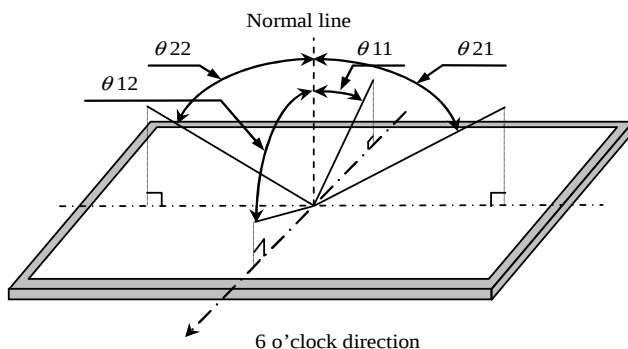
- Viewing angle range: EZ-CONTRAST

- Response time: Photodiode



Measurement of Contrast, Luminance, Chromaticity.

[Note1] Definitions of viewing angle range:



[Note2] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

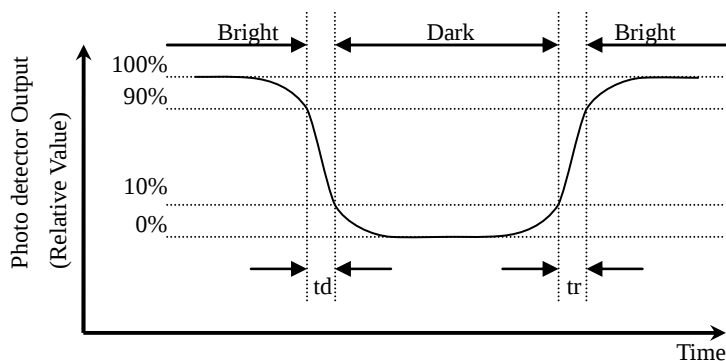
[Note3] Definition of response time

The response time ( $\tau_{rd}$ ) is defined as the following.

$$\tau_{rd} = \{\sum (tr : x - y) + \sum (td : x - y)\} / 20$$

$\tau_{rd}$  is the average value of the switching time from five gray levels (0%, 25%, 50%, 75% and 100%) to five gray levels (0%, 25%, 50%, 75% and 100%).

|                         |      | Gray level of End (y) |              |              |              |              |
|-------------------------|------|-----------------------|--------------|--------------|--------------|--------------|
|                         |      | 0%                    | 25%          | 50%          | 75%          | 100%         |
| Gray level of Start (x) | 0%   |                       | tr: 0%-25%   | tr: 0%-50%   | tr: 0%-75%   | tr: 0%-100%  |
|                         | 25%  | td: 25%-0%            |              | tr: 25%-50%  | tr: 25%-75%  | tr: 25%-100% |
|                         | 50%  | td: 50%-0%            | td: 50%-25%  |              | tr: 50%-75%  | tr: 50%-100% |
|                         | 75%  | td: 75%-0%            | td: 75%-25%  | td: 75%-50%  |              | tr: 75%-100% |
|                         | 100% | td: 100%-0%           | td: 100%-25% | td: 100%-50% | td: 100%-75% |              |



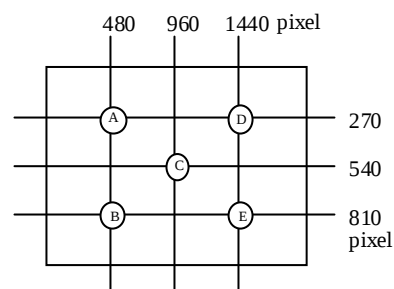
[Note4] This value shall be measured at center of the screen.

[Note5] This value is valid when O/S driving is used at typical input time value.

[Note6] Definition of white uniformity ;

White uniformity is defined as the following with five measurements. (A~E)

$$\delta_w = \frac{\text{Maximum luminance of five points (brightness)}}{\text{Minimum luminance of five points (brightness)}}$$



## 11. Packing form

- a) Piling number of cartons : 2 Maximum  
 b) Packing quantity in one carton : 9pcs  
 c) Carton size : 1982(W) × 1110(D) × 1297(H)  
 d) Total mass of one carton filled with full modules : 393kg

## 12. Carton storage condition

|                     |                                                                                                                                                                                                                                                          |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature         | 0°C to 40°C                                                                                                                                                                                                                                              |
| Humidity            | 95% RH or less                                                                                                                                                                                                                                           |
| Reference condition | 20°C to 35°C, 85% RH or less (summer)<br>5°C to 15°C, 85% RH or less (winter)<br>the total storage time (40°C, 95% RH) : 240h or less                                                                                                                    |
| Sunlight            | Be sure to shelter a production from the direct sunlight.                                                                                                                                                                                                |
| Atmosphere          | Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected.                                                                                                                                                |
| Notes               | Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall.<br>Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment. |
| Storage life        | 1 year.                                                                                                                                                                                                                                                  |

## 13. Reliability test item

| No. | Test item                                         | Condition                                                                                                                                                                                                                                                                                                    |
|-----|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | High temperature storage test                     | Ta=60°C 240h                                                                                                                                                                                                                                                                                                 |
| 2   | Low temperature storage test                      | Ta=-25°C 240h                                                                                                                                                                                                                                                                                                |
| 3   | High temperature and high humidity operation test | Ta=40°C ; 95%RH 240h<br>(No condensation)                                                                                                                                                                                                                                                                    |
| 4   | High temperature operation test                   | Ta=50°C 240h                                                                                                                                                                                                                                                                                                 |
| 5   | Low temperature operation test                    | Ta=0°C 240h                                                                                                                                                                                                                                                                                                  |
| 6   | Vibration test (non-operation)                    | Frequency: 10~57Hz/Vibration width (one side): 0.075mm<br>: 58~500Hz/Acceleration: 9.8 m/s <sup>2</sup><br>Sweep time: 11 minutes<br>Test period: 3 hours (1h for each direction of X, Y, Z)                                                                                                                 |
| 7   | ESD                                               | * At the following conditions, it is a thing without incorrect operation and destruction.<br>(1)Non-operation: Contact electric discharge ±10kV<br>Non-contact electric discharge ±20kV<br>(2)Operation Contact electric discharge ±8kV<br>Non-contact electric discharge ±15kV<br>Conditions: 150pF, 330ohm |

[Result evaluation criteria]

Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

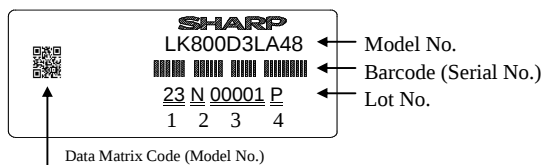
## 14. Others

### 14.1 Serial Label

The label that displays SHARP, product model (LK800D3LA48), a product number is stuck on the back of the module.

#### a) Overview

This label is stuck on the backlight chassis.



#### b) How to express Lot No.

| Model No.   | 1  | 2 | 3     | 4                       |
|-------------|----|---|-------|-------------------------|
| LK800D3LA28 | 23 | N | 00001 | P                       |
|             |    |   |       |                         |
|             |    |   |       | Suffix Code<br>P or T   |
|             |    |   |       | Serial No.              |
|             |    |   |       | Factory Code<br>N NSEC  |
|             |    |   |       | Production Year & Month |

### 14.2 Packing Label

This label is stuck on the each packing box.

ex) LK800D3LA48

社内品番 : (4S) LK800D3LA48P

Barcode (①)

Lot No. : (1T) 2012. \*. \*\*

Barcode (②)

Quantity : (Q) \* pcs

Barcode (③)

ユーザ品番 :

シャープ物流用ラベルです。

① Model No.& Suffix Code

② Lot No.

③ Quantity

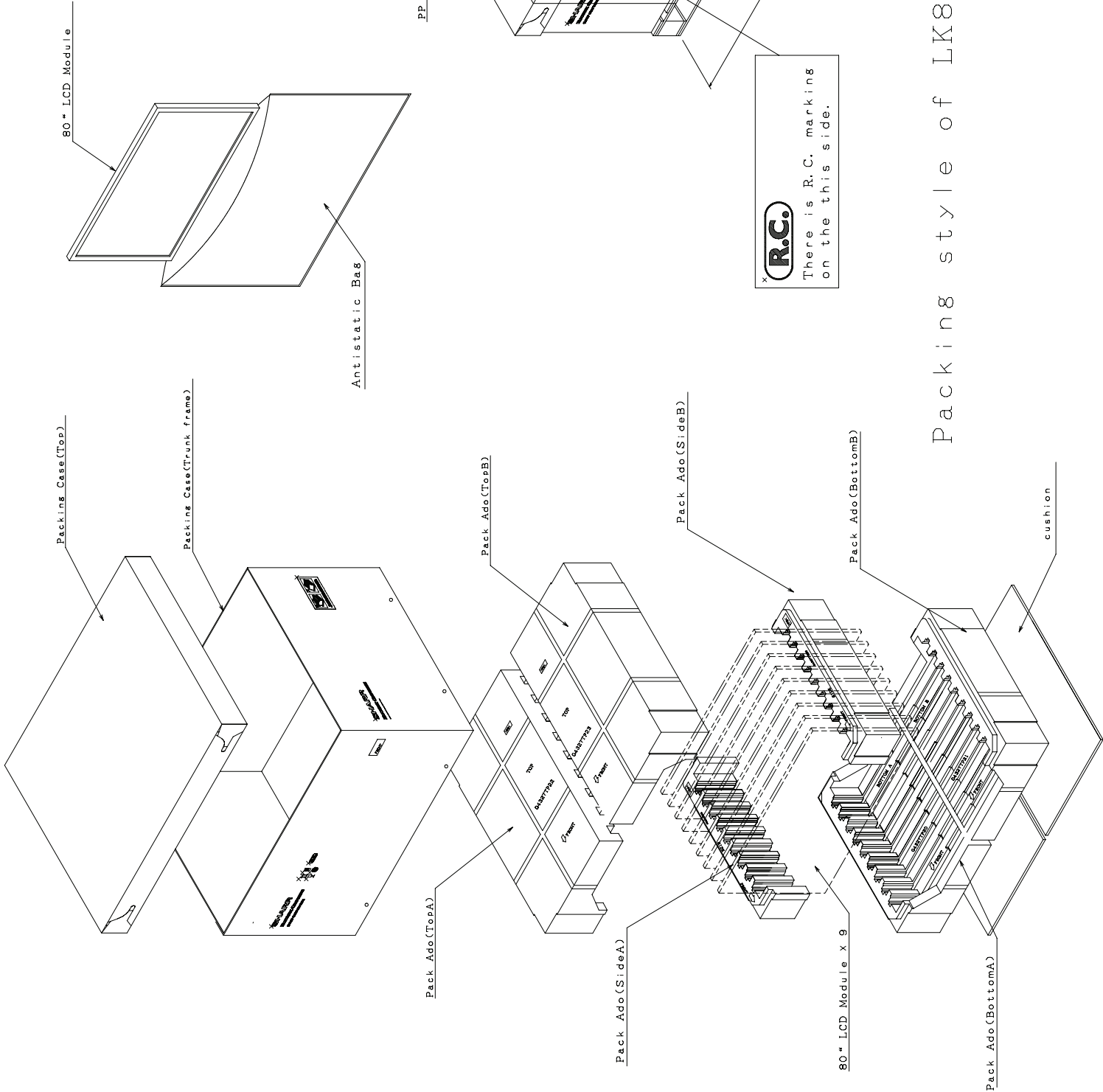
## 15. Precautions

- a) Be sure to turn off the power supply when inserting or disconnecting the cable.
- b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- c) Since the front polarizer is easily damaged, pay attention not to scratch it.
- d) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.
- e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
- g) Since CMOS LSI is used in this module, take care of static electricity and take the human earth into consideration when handling.
- h) The module has some printed circuit boards (PCBs) on the back side, take care to keep them from any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.
- i) Observe all other precautionary requirements in handling components.
- j) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc. So, please avoid such design.
- k) When giving a touch to the panel at power on supply, it may cause some kinds of degradation. In that case, once turn off the power supply, and turn on after several seconds again, and that is disappear.
- l) When handling LCD module and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.
- m) This LCD module is designed to prevent dust from entering into it. However, there would be a possibility to have a bad effect on display performance in case of having dust inside of LCD module. Therefore, please ensure to design your TV set to keep dust away around LCD module.
- n) This LCD module passes over the rust.
- o) Adjusting Vcom has been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.
- p) Disassembling the module can cause permanent damage and should be strictly avoided.
- q) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
- r) The chemical compound, which causes the destruction of ozone layer, is not being used.
- s) In any case, please do not resolve this LCD module.
- t) This module is corresponded to RoHS.
- u) When any question or issue occurs, it shall be solved by mutual discussion.





| Parts Name                | Material  |
|---------------------------|-----------|
| Packing Case(Top)         | Cardboard |
| Pack Ado(BottomA)         | PS        |
| Pack Ado(BottomB)         | PS        |
| Pack Ado(TopA)            | PS        |
| Pack Ado(TopB)            | PS        |
| Pack Ado(SideA)           | PS        |
| Pack Ado(SideB)           | PS        |
| cushion                   | PS        |
| Packing Case(Trunk frame) | Cardboard |
| Plywood Palette           | Plywoods  |
| Antistatic Bag            | PE(t=20μ) |



Packing style of LK800D3LA28/38/48